Name:___ Date:___

Polynomial Operations SOLUTIONS (version 37)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 8x^5 + 2x^4 - 5x^2 + 4x - 1$$

$$q(x) = 3x^5 - x^4 - 4x^3 + 7x + 2$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (8)x^5 + (2)x^4 + (0)x^3 + (-5)x^2 + (4)x^1 + (-1)x^0 \\ q(x) &= (3)x^5 + (-1)x^4 + (-4)x^3 + (0)x^2 + (7)x^1 + (2)x^0 \\ p(x) + q(x) &= (11)x^5 + (1)x^4 + (-4)x^3 + (-5)x^2 + (11)x^1 + (1)x^0 \\ p(x) + q(x) &= 11x^5 + x^4 - 4x^3 - 5x^2 + 11x + 1 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 4x^2 + 8x - 7$$

$$b(x) = -2x - 5$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$4x^2$	$8x$	-7
$-2x$	$-8x^3$	$-16x^2$	$14x$
-5	$-20x^2$	$-40x$	35

$$a(x) \cdot b(x) = -8x^3 - 16x^2 - 20x^2 + 14x - 40x + 35$$

Combine like terms.

$$a(x) \cdot b(x) = -8x^3 - 36x^2 - 26x + 35$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 3x^3 + 25x^2 + 12x + 23 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 3 & 25 & 12 & 23 \\ -8 & & -24 & -8 & -32 \\ \hline & 3 & 1 & 4 & -9 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 3x^2 + x + 4 + \frac{-9}{x+8}$$

In other words, $h(x) = 3x^2 + x + 4$ and the remainder is $R = -9$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 3x^3 + 25x^2 + 12x + 23$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (3)\cdot(-8)^3 \ + \ (25)\cdot(-8)^2 \ + \ (12)\cdot(-8) \ + \ (23) \\ &= (3)\cdot(-512) \ + \ (25)\cdot(64) \ + \ (12)\cdot(-8) \ + \ (23) \\ &= (-1536) \ + \ (1600) \ + \ (-96) \ + \ (23) \\ &= -9 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x + 8$. Thus, $f(-8) = -9$.